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ABSTRACT

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Empirical Fact or Social Fact?

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Abstract

This paper examines the possibility of a Kuhnian paradigm in research on educational communications and technology. It discusses Kuhnian metaphor and its attraction as a viewfinder. It turns to anthropology for explanation of how beliefs and behaviors become social fact. Then it takes a critical look at usage of this metaphor in the field as a social text. It concludes by discussing the schism between researchers and practitioners in the ways they know the world.

Empirical Fact Or Social Fact?

Kuhn's metaphorical book *The Structure of Scientific Revolutions* (1970) has itself become a metaphor since its first publication in 1962. Kuhn used citation analysis, an empirical historical method, for building his model of how empirical thought develops in physics and astronomy. There is irony in empiricists from other disciplines borrowing his model for they do not apply his methodology. They account for their own fields with rational tools they would not normally allow in their work due to lack of empirical rigor. Invoking the authority of the Gospel of Saint Thomas Kuhn is no rarity in the second half of the twentieth century. The scripture of revolution has been adopted as the text for business as usual. The metaphorical structure has diffused from describing scientific research to the point that it applies to almost any perceived state or desired change, including improvements in computer operating systems. Perhaps the dying metaphor will receive burial when it becomes a household word. I imagine the day when advertising copywriters use *paradigm shift* as a replacement for *new improved classic taste.*

Empirical Mythology

Scholarly Knowledge About Educational Communications And Technology

The twentieth century disenchantment with epistemology, with metaphysics, and with philosophy as the guiding light of the sciences has resulted in confusion. Logical empiricism claims objectivity but fails any test of neutrality because science in action is a sociopolitical business with sociopolitical aims. Social scientists intend to understand social facts but seldom know why those facts have been selected for study or, indeed, how their discipline creates social facts. Scholars of education borrow theory and methods from these researchers. Confined by social discontinuities, the field of educational communications and technology cuts across education.

Social Facts

There are two kinds of human action, writes Suchman in describing the large contribution of G. H. Mead to her theory of situated action (1987). One is actually acting and the other is derivative in that it plans for the future and retrospectively accounts for the past. These projections or reconstructions become the social facts. The social text is not mere discourse but becomes part of the action. Rabinow looks specifically at scholarly representations as social facts (1986) and this is a recurrent theme in contemporary cultural anthropology (Clifford & Marcus, 1986; Geertz, 1973, 1983, 1988). These social facts are interpretations. In contrast, cognitive scientists should have difficulty with this concept because they accept words as equivalent to the objects they denote. Winograd and Flores (1987) have given the name *naïve realism* to this commitment to rationalism.

How Do Beliefs And Behaviors Become Social Fact?

Harris has proposed a theory of cultural evolution that accounts for how beliefs and behaviors are formed in response to environmental pressures (1968, 1983). There is no good reason to expect that intelligent life grows and reacts in the same way that mold on a crust of bread grows and reacts. Harris' theory of cultural materialism explains that beliefs and behaviors are shaped by the fundamental issues of food supply and population growth (1985). He has also extrapolated his theory to hyperindustrial American life (1987). His theory will be used later in this paper to show that claiming a paradigm of educational communications and technology performs a social function.

An Empirical Factfinding Mission Towards Prediction

Ever since the visual education movement emerged in the 1920s due to the frequent installation of motion picture projectors in schools, researchers have been concerned with justifying the pretheoretical assumption that technology can improve instructional effectiveness and efficiency. They act in accord with the scientific management reforms described by Callahan (1962) and Cuban (1986, p. 86-88). In a landmark investigation funded by a $10,000 grant, Freeman supervised the 13 studies reported by his assistants (1924). Their results suggested that visuals convey a different kind of information from that conveyed by language. Under the sponsorship of the Eastman Kodak Company, he disregarded his own conclusions and conducted a widely publicized media comparison experiment (Wood & Freeman, 1929). Over a period of 12 weeks, 20 films were shown to 11,000 children in 12 cities. Wood and Freeman had the 80,000 test booklets scored and found that film students provided more concrete answers to descriptive questions while giving answers to abstract questions that were equal to those given by the control group. This quantification justified educational motion pictures as a panacea and fitted in with the agenda of Freeman's dean, Charles Judd–see Clifford and Guthrie (1988, p. 78)–for establishing a science of education.

The tradition of experimental psychology in our field is the basis for claiming a cognitive paradigm. This reductionist line of research continued for over 65 years with spurts of excitement as each new medium appeared, see Dale, Dunn, Hoban Jr. and Schneider (1937), McClusky (1950), Saettler (1968) and Wilkinson (1980). In 1970, Heinich announced in his monograph *Technology and the Management of Instruction* the replacement of a behavioristic paradigm based on objective, observable behavior with a paradigm for learning theory. Clark and Salomon (1986) document this as a reality but unlike Heinich they do not refer to Kuhn. Clark and Sugrue reviewed the last decade of research on instructional media and identified four types of research: behavioral, cognitive, attitudinal and economic (1988). Their narrow perception of paradigm shift in educational media centers on "the new cognitive theories of learning from instruction" with achievement as the dependent variable. Winn expresses a strong belief in learning as the "bottom line" (1988, 1989) and so does Clark (1989). By learning they mean the transformation of individual minds and not the social process. Ironically,

those who profess the cognitive paradigm are also charged with giving stamps of social approval to the practitioners who design and administer instruction. No wonder Winn writes, "...there has always been opposition within the field to research and theory that has at times bordered on hostility." (1988, p. 808).

Understanding The Transmission Of Culture

A crack is showing in the cognitive egg but no chick is ready to hatch. In contrast to the traditional reductionist research, cognitive scientists themselves are objecting that the interactions which make up knowledge communication cannot be isolated from situational dimensions (Suchman, 1987) and cultural fabric (Lave, 1988). From this viewpoint, sociocultural research apart from the mainstream represents a strength of educational communications and technology's position as an applied field.

The scholars investigating this dimension recognize that much more is at stake in educational communications and technology than achievement, which is only the ostensible purpose of schooling. Their work is closer to practice because it represents the need to solve real world problems. Driven by sociocultural research issues, their investigations cross the breadth of theories and methods of the social sciences and the humanities. For example, Belland, Duncan & Deckman (1985), Becker, (1986), Hlynka (1989), Januszewski (1988), Koetting (1988), Muffoletto (1987) and Taylor & Swartz (1988) are concerned about critically understanding cultural reproduction. They write in what Husen (1988) identifies as educations' other research paradigm: the humanistic way of knowing, as opposed to neopositivism/logical empiricism.

Kuhn's Gospel

A Stained Glass Window

Kuhn created his model to explain the results of his bibliographic research on the history of science (1970). His views opposed Popper's principle of falsifiability that had been accepted for three decades (Popper, 1968). In the Popperian tradition the research strategy competition in science is far from futile. It is thought advantageous because the credibility of steadystate knowledge rests not on dogma but on refinement and replacement by more powerful theories and closer approximations of truth. Popper, himself, had been a radical in asserting the superiority of empirical observation over the acceptance of scientific theories by agreement between authorities. Kuhn questioned Popper's textbook explanation of continual, rational progress.

Kuhn's scripture contains three central metaphors: paradigm, anomaly and revolution. The paradigm is an accepted set of rules for knowing about and conducting normal science. The anomaly is the exception that stimulates new explanations that cannot be ignored. The revolution is the emergence of a new paradigm.

Kuhn identified three normal foci of factual scientific investigation (1970, p. 25-30). They sometimes overlap and I have added the parenthetical phrases to improve the distinctions:

Determination of significant fact (applying research strategies).
Paradigmatic facts are developed for solving paradigmatic problems. Measurement occurs with increasingly refined apparatus and methods. Some researchers receive more recognition for developing research tools than for what they find.

Matching facts with theory (addressing research issues).
Increasing the match between theory and nature comes from arguments and/or factfinding demonstrations rooted in the real world: "The existence of the paradigm sets the problem to be solved."

Articulating theory.
A paradigm is articulated by looking for universal constraints, quantitative laws and experiments, in a more qualitative sense, that elucidate a phenomenon and relieve ambiguous interpretations.

This is not falsification (Kuhn, 1970, p. 77-80). New basic theories appear in the short revolutionary period of extraordinary science but new paradigms are incommensurable with previous paradigms. In the long periods of normal science, the reigning paradigm restricts researchers to puzzle solving science in which assumptions are not questioned.

Kuhn (1970) further questioned modern rationality by doubting the neutrality of investigators and suggested the importance of considering sociological and individual psychological aspects. He stated, "Lifelong resistance, particularly from those whose productive careers have committed them to an older tradition of normal science, is not a violation of scientific standards but an index to the nature of scientific research itself." (p. 151). This relativistic approach led to debates with other philosophers and historians of science including Popper, who defended the neutrality of scientists, and Feyerabend, who welcomed subjectivity and opened the back door to mysticism. Further debate with Lakatos chased empiricism into a corner and Kuhn demonstrated the importance of scientific consensus in determining hard facts (Lakatos & Musgrave, 1970).

Over the years Kuhn's bibliographic analyses increased in particularity because each revolution requires a unique explanation. His original metaphors did not fit all situations. For instance, he discovered differing paradigms for chemistry and physics that described helium either as an atom or as a molecule (1970, p. 50-51) and he drew parallels from science to art, from theories to painting styles (1977, p. 340-351). With refinement, Kuhn's model was reduced in scale from paradigms in conflict to theories in conflict. There is an admitted lack of generality, partly in response to close examinations of the issues, see the table illustrating Stegmüller's chapter on "Kuhnianism": Pseudoirrationalism and Pseudorelativism, (1976, p. 241-246). Barnes shows that Kuhn's ideas have become progressively more conformist, conservative and more supportive of the scientific establishment (1983). *Paradigm* has lost

its revolutionary fire: it may mean no more than *Weltanschauung* as a metaphysical, epistemological and methodological perspective.

The Kuhnian Scriptures And Social Science

In examining the relationship of Kuhn to our field, it is first necessary to review Kuhn's influence on the social sciences, the source of our theories and research methods. Kuhn ventured "...it remains an open question what parts of social science have yet acquired such paradigms at all. History suggests that the road to a firm research consensus is extraordinarily arduous." (1970, p. 15).

What attracted Barnes to write on *T.S. Kuhn and the Social Sciences* (1984), despite Kuhn avoiding extrapolation of his ideas to the social sciences, was Kuhn's central argument that more is going on in science than an academic competition of ideas. Barnes describes the dangers of Whig history, of viewing the past as a reflection of the present, and of writing textbooks that present only facts that support current understandings. He also uses the phrase "intellectual laziness" (p. 120) to show that he does not endorse the dogmatic acceptance of Kuhn's model as an after the fact explanation in sociology, economics or psychology.

Kuhn (1970) cautioned:

"The members of all scientific communities, including the schools of the "pre-paradigm" period, share the sorts of elements which I have collectively labeled "a paradigm." What changes with the transition to maturity is not the presence of a paradigm but rather its nature. Only after the change is normal puzzle-solving research possible." (p. 179).

This is not enough. Just as early psychological researchers had physics envy (Gould, 1986, p. 262-263) and some social sciences have been the subject of debates over whether they are really scientific or not (Kuhn, 1970, p. 160), the acknowledgement of a paradigm is socially desirable as a sign of a discipline's intellectual adulthood. Cognitive psychologists claim that understanding Kuhnian paradigm shifts in their field is central to understanding cognitive psychology (Lachman, Lachman & Butterfield, 1979). In linguistics there was a Kuhnian diffusion of ideas through a new generation (Gardner, 1986, p. 209). Even parapsychologists are attracted by the orthodoxy of Kuhnian metaphors (Barnes, 1983, p. 90-93; Radner & Radner, 1982, p. 62-67).

Mitchell (1979), an English professor, could explain why no area wants to be regarded as preparadigmatic:

"We can always tell which of two crafts outranks the other by looking at its lexicon. Jargon only runs downhill. You will notice that although educators have borrowed "input" from the computer people, the computer people have felt no need to borrow "behavioral objectives" or "preassessment" from the educators." (p. 106)

The Cognitive Paradigm Metaphor As A Social Text

As the author of a classic work, Kuhn has endured the fate of classic authors in that his scripture has been more often cited than read (Adams & Searle, 1986, p. 381). This can be understood in the same way Johnson-Laird (1988, p. 21) debunks Lévi-Strauss and Piaget: "A theory may be so rich in descriptive possibilities that it can be made to fit any data." In other words, "Even things that are true can be proved," (Wilde, 1891/1976, p. 5).

The cognitive paradigm in educational communications and technology is a social text that encourages cooperation in the joint productive effort like the boost in agricultural production from a Kwakiutl chief redistributing wealth at a potlatch (Harris, 1974) or the feast of a Solomon Islands mumi (Harris, 1977). Having a paradigm is an indication of being established. The transition from preparadigm state to postparadigm state is widely perceived as the passage of puberty for any discipline. From the viewpoint of cultural evolution, claiming a paradigm has adaptive value. It helps people obtain and maintain employment. If they say they are believers they increase their chances of survival in the job market. Conflict is discouraged because it decreases material growth. Allowing people to examine what they do and why they do it causes schisms and these reduce the centralized power. Grandiose claims impress other big men[1] such as granting agencies and they reassure school district superintendents and corporate directors of instructional systems that someone really knows what is going on. Everything appears under control and the scholars who claim a cognitive paradigm on the elite campuses promise to bend their research efforts to everyone's benefit.

Another interpretation fits just as well because the same social mechanism could exist without actual paradigmatic consensus. If there is a Kuhnian paradigm in educational communications and technology, why does it mimic what Apple and Weiss (1983, p. 3) call the dominant, achievement measuring tradition of educational research? In Kuhn's scripture, preparadigmatic research is characterized by the atheoretical factfinding characteristic of prescientific times (1970, p. 15-16). Explanations of phenomena are inadequate. Data are too dense for decoding. Details are missed which are later considered important. In preparadigmatic research, technology is the name given to solving practical problems systematically. Technology mothers science.

In our field the technique is the systems approach to instructional management, also identified by Heinich as the result of paradigm shift (1970). Today the technique is known as Instructional Systems Development (ISD). The field has become more complex in the two decades since Heinich's observation and choosing between prescriptions is increasingly difficult. In a recent study, 30 ISD models were identified and compared for 12 major tasks (Taylor & Doughty, 1988). Further, Reigeluth (1989) warns that research and development may be out of touch with each other.

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[1] This phrase comes from anthropology.

Alternatives To The Received Research Agenda

From the cultural materialist point of view, individuals and groups can still use their intellect to choose what they want to believe and what they want to do. Harris thinks that despite lack of evidence of this in the past, it may be the only hope for our planet in the face of the ecological emergency (1987, p. 181-183). In our field, for example, we might turn aside from the mechanical study of achievement and select the direction of Habermasian morality:

"...education should function, via communicative action, to help us competently reach understanding with one another (the cultural function), fulfill appropriate societal norms (the social function), and develop our personalities (the socialization function), and in the process, learners become involved with objective, practical and emancipatory forms of knowledge." (Nichols, 1989, p. 9)

As a further example of an alternative to measuring achievement, I suggest looking for the special contributions of educational media in giving learners experiences which they can shape for themselves. I suggest evading the politics of schooling by finding ways of preventing the arbitrary constraints of time and place from interfering in individual learning. Also, I encourage educators to take an ethical stance and accept that achievement differences are not only unimportant but they are to be expected as normal and healthy. Achievement differences among the normal population not only do not need to be overcome but they should not be overcome.

The Schism Between Researchers And Practitioners

As an applied field, the Kuhnian paradigm of revolutionary process does not fit educational communications and technology and neither does the falsificationist myth of orderly progress. The description of the preparadigmatic state may fit equally well or even better. Nevertheless, Kuhn's contribution in identifying the sociopolitical underpinnings of science remains and there are material pressures for *claiming* a cognitive paradigm. That claim is a social fact, whether it is true or not.

The research base of educational communications and technology is scientific but the practice is not the practice of science. Technological determinism has a circular logic: Instructional science resembles medicine which is an applied science (Reigeluth, 1984, p. 20) but education is also claimed as an art (De Landsheere, 1988, p. 16). The split is well known from C. P. Snow's *Two Cultures* essay (1959/1965) and his semiautobiographical novel *The Search* (1935/1958). Hlynka argues for the necessity of both approaches and both metaphors in our technological field (1984). There remains a paradox in that the practice of educational communications and technology is not the practice of education. Jonassen, for instance, writes: "Educational technology is the *science* of instruction..." (1984, p. 159).

The cognitive research paradigm is so concerned with product that it can have no meaningful response to process questions such as Apple's "Is the new

technology part of the solution or part of the problem in education?" (1988, p. 150). For example, quantitative tests show significant differences between students' levels of computer anxiety (Glass & Knight, 1988) but reliable measurements do not support the validity of a construct (Cherryholmes,1988). The results have been applied without regard for their validity. The consequences of computer anxiety research reports provide evidence that technology is not neutral and that science can be used to dominate people.

The interaction between the design of things and the design of instruction reveals the politics of the received research agenda in educational communications and technology. Norman (1988, p. 40-43) believes that badly designed hardware and software teach people to be helpless when working with technological items. In contrast to that cognitive engineering viewpoint it is incongruous that the computerphobia programs deliberately teach people they are helpless. These interventions tell people they are ineffective and incapable and that they need special instruction to get over their disability. I disagree with these procedures and my values are probably similar to the ones you hold: I believe that things need fixing, not people. My comment is that the act of teaching teachers and students that they are computer anxious, that they are helpless, that they need remediation, may be an oppressive act. Sociocultural issues such as these need to be explored with research based on sound, theoretical foundations drawn broadly from the social sciences and the humanities.

Educational communications and technology is rooted in the practice of using and producing educational media but researchers do one set of things and practitioners do another set of things. Classroom teachers, school media coordinators and instructional system developers select images to convey the world to learners. They know the field is effective because educational media employ rhetoric. The field is poetic, lyric, dramatic, epic and alive with metaphors. Researchers investigate to write scholarly research reports but educational cinematographers investigate to create films and videos. The way of saying something changes what is said. In practice, far beyond the dusty educational psychology journals that fill shelf after shelf of university libraries, we have an artistic, creative, imaginative field.

Adams' *Philosophy of the Literary Symbolic* (1983) confronts the tension between the literary and the scientific ways of knowing: "The war between poetry and philosophy has extended from before Plato's time into our own." (p. 389). These words also apply to educational communications and technology. More than a paradigm, debates between researchers and between researchers and practitioners ensure conscious decisions. More than a paradigm, the field needs this conflict between the poetry of practice and the philosophy of research.

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